

## Urological Neurology and Urodynamics

### URODYNAMIC EVALUATION OF HYPOSPADIAS REPAIR

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#### ABSTRACT

**Purpose:** We performed a cross-sectional evaluation of voiding in a population undergoing hypospadias repair to determine whether patients had urinary obstruction at various intervals of followup after the last operation.

**Materials and Methods:** Of approximately 600 patients undergoing hypospadias repair at our department during a 30-year interval 175, 40 months to 66 years old were evaluated. Therefore, we created a cross-sectional study group for evaluation of voiding function. All patients had undergone the final operation for hypospadias at least 1 year previously and were toilet trained. Severity of the initial hypospadias was scored together with the operative technique. Parameters evaluated were medical history, physical examination and uroflowmetry using a rotating disk. Uroflowmetry data (maximum flow rate and voided volume) were plotted in age-related nomograms in 4 different age groups: less than 8 (28 patients), 9 to 14 (18), 15 to 21 (39) and more than 21 (91) years old. All flow charts were evaluated by 2 of us (J. F. A. v. d. W. and E. B.).

**Results:** The severity of initial disease was grade 1 in 30% of the patients, grade 2 in 57%, grade 3 in 10%, grade 4 in 2% and unknown in 2%. The operative technique performed was a van der Meulen repair in 113 patients (65%), a combined Byars-Denis Browne repair in 56 (32%) and miscellaneous in 6 (3%). According to the uroflowmetry nomograms there was a tendency for an increased number of patients to have a normal maximum flow rate with increasing age. A total of 14 patients had a flow curve that suggested distal urethra obstruction and none was symptomatic. There was no difference in uroflowmetry characteristics regarding the operative technique.

**Conclusions:** No difference in uroflowmetry could be established among the operations. There seemed to be a tendency towards improvement in uroflowmetry with increasing followup. There was no direct relationship between low maximum flow rates and clinical apparent obstruction.

**KEY WORDS:** urodynamics, penis, urethra, hypospadias

Reconstruction of the distal urethra in hypospadias patients must be evaluated beyond adolescence.<sup>1</sup> Several strategies can be followed in this assessment. A consequent patient followup should be completed with 1 or more objective parameters.

Voiding and ejaculation are the 2 main functions of the newly formed urethra, the latter being difficult to measure qualitatively. Voiding can be visualized qualitatively (for example voiding cystourethrography or excretory urography) or quantitatively (uroflowmetry or cystometry). Uroflowmetry is a widely accepted technique for screening voiding function.<sup>2</sup> It is easy to perform, noninvasive, reliable and relatively inexpensive. We established the voiding function of a population undergoing hypospadias repair as part of a larger study concerning the long-term followup of patients from our department reflecting 30 years of experience with hypospadias surgery.

#### MATERIALS AND METHODS

From the files of our department of plastic and reconstructive surgery a cross-sectional group of 175 patients was selected who underwent hypospadias repair. Primary and secondary referred patients were included in this study. The

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severity of the initial hypospadias was grade 1 (glandular) in 52 patients (30%), grade 2 (coronal) in 99 (57%), grade 3 (penile) in 17 (18%), grade 4 (scrotal) in 3 (2%) and unknown in 4 (2%). The number of operations, operative technique, and number and nature of complications were evaluated (table 1). Patient age at first operation varied from 1 to 55 years. All primary referred patients underwent initial surgery before age 6 years. For the secondary referred patients initial surgery depended on the age at referral. Because the study group was a cross section through a population undergoing hypospadias repair, followup varied concordantly. No urethral dilations were performed in the patients.

Surgery was performed according to the method of van der Meulen, which uses a dorsal transposition flap for coverage of the ventral surface and reconstruction of the urethra.<sup>3</sup> This operation was performed in 1 (type 1) or 2 (type 2) stages depending on the severity of hypospadias. The

TABLE 1. Operation methods in 175 patients

Technique	No. Pts.	Mean No. Operations
Van der Meulen (type I or II)	113	1.5
Byars-Denis Browne	56	2.4
Miscellaneous	6	1.7

alternative procedure was a combined Byars-Denis Browne repair, which was always done in 2 stages.<sup>4</sup>

All patients were interviewed, and physical examination and uroflowmetry were performed. Suspicion of obstruction following uroflowmetry was never associated with clinical obvious obstruction. Therefore, no other urodynamic parameters were measured. Age distribution of the study population varied from 3.3 to 66 years. All patients had undergone the last operation more than 1 year previously and were toilet trained. Uroflowmetry was performed with a rotating disk uroflowmeter. Measurements included delay time, voiding time, flow time, time to maximum flow, maximum and average flow rates, and voided volume. For evaluation, maximum flow rate and voided volume were considered only, and were plotted in age-related nomograms<sup>5</sup> in 4 age groups (less than 8, 8 to 14, 15 to 21 and more than 21 years old). All uroflowmetry charts were reviewed by 2 of us (J. F. A. v. d. W. and E. B.) independent of patient records. Finally, review of uroflowmetry was combined with patient records and medical history.

### RESULTS

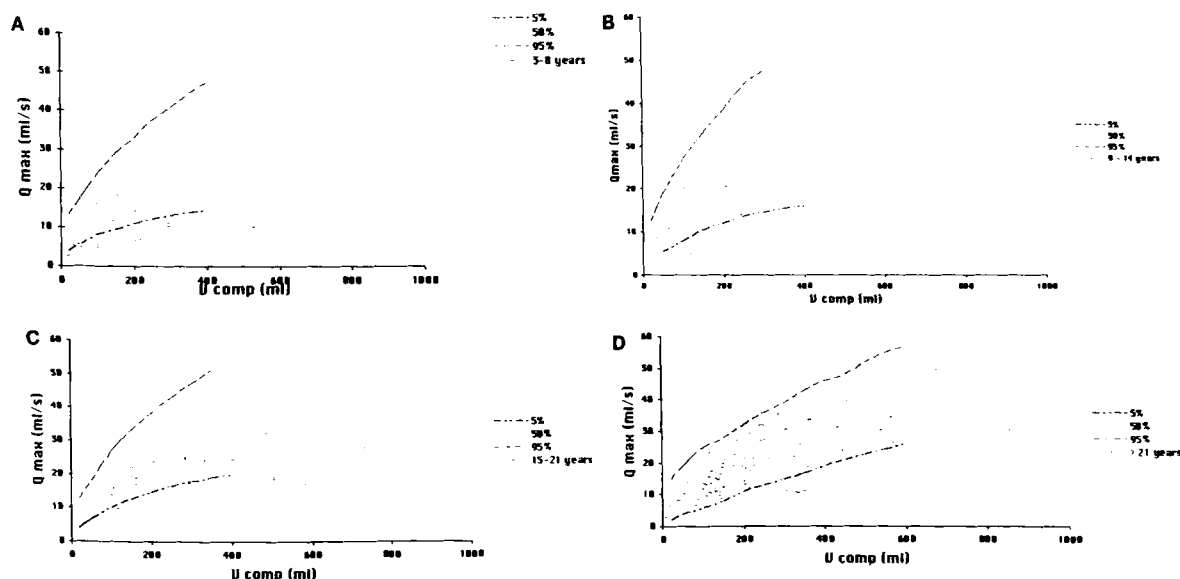
Of the 175 patients interviewed 27 (15%) complained of intermittent spraying, 1 had painful voiding and 3 had recurrent lower urinary tract infections. Physical examination revealed no meatal stenosis. In some patients spraying could be attributed to skin irregularities at the meatus, although this was not a consistent finding. Uroflowmetry data (maximum flow rate and voided volume) were plotted in age-related nomograms<sup>5</sup> according to 4 different groups (see figure). Because no difference could be established according to the operative technique all patients were combined. In the 3 to 8-year age group a relatively large number of patients had low maximum flow rates (10, or 50%, <P5). In the 9 to 14-year age group this number was much smaller but still substantial (7, or 28%). Interpretation of these data in the group between 15 and 21 years old was somewhat difficult because no normal values for maximum flow rate at large voided volumes were known from the literature. Estimating beyond these normal values showed a maximum of 6 patients (15%) with values of maximum flow less than P5. The large group of patients older than 21 years comprised 10 (11%) with a low maximum flow rate.

Review of the uroflowmetry charts showed 108 patients with a normal profile, 20 with mild suspicion for obstruction, 14 with suspicion for obstruction and 2 with probable bladder dysfunction. The flow data for 31 patients were not conclusive but not obstructive. Combination of the flow data with the interview showed that no patient with an abnormal flow pattern complained of straining, voiding pain, hesitation or recurrent lower urinary tract infection. Patients with lower than normal flow rates did not differ according to the initial severity of hypospadias, operative technique or urinary diversion technique.

The 3 patients with recurrent urinary tract infection had a normal maximum flow rate and voided volume with normal flow patterns. One patient complained of voiding pain but in retrospect this was not severe and of intermittent character. He did not have meatal stenosis and uroflowmetry charts did not show any abnormalities.

### DISCUSSION

Hypospadias is a congenital anomaly for which many operations have been advocated.<sup>6</sup> Numerous techniques with subsequent modifications have been reported in the literature, while there have been fewer reports concerning long-term followup of these techniques. Functional results of some procedures using uroflowmetry have been described even less frequently. Kumar and Harris presented a group of 21 patients who underwent the Harris technique with an age distribution at followup of 13 to 25 years (table 2).<sup>7-12</sup> This group showed only 1 patient (5%) with a low maximum flow rate but a large number of patients (40%) with intermittent spraying. Svensson et al reported on 33 patients 15 to 34 years old evaluated after a Denis Browne technique.<sup>8</sup> Spraying was frequent in this series as well (39%), with 15% of the patients having a low maximum flow rate. Jayanthi et al described 2 distinct age groups (3 to 7 and 8 to 14 years old) undergoing a vascularized or tubed preputial island flap.<sup>9</sup> However, their flow data were inconsistent with the illustrations, and so no conclusions can be drawn. Festge et al also reported on 2 age groups (3 to 7 and 8 to 13 years old).<sup>10</sup> In the first group 52% of patients had lower than normal maximum flow rates, while in the older age group this ratio was 27% (overall average 40%). Garibay et al reported on 32 relatively young children (3.6 to 8.6 years old) undergoing



Age-related nomogram for voided volume ( $V_{comp}$ ) and maximum flow rate ( $Q_{max}$ ). Maximum flow rate was less than P5 (----) in 10 (A), 7 (B), 6 (C) and 10 (D) patients 3 to 8, 9 to 14, 15 to 21 and more than 21 years old, respectively.

TABLE 2. Procedures for hypospadias repair

References	No. Pts.	Age Range (yrs.)	% Spraying	% Low Flow Rates
Kumar and Harris <sup>7</sup>	21	13-25	40	5
Svensson and Berg <sup>8</sup>	33	15-34	39	15
Jayanthi et al <sup>9</sup>	80	3-7, 8-14	No data	31
Festge et al <sup>10</sup>	54	5-16	40	40
Garibay et al <sup>11</sup>	32	0.6-8.6	No data	20
MacMillan et al <sup>12</sup>	44	2-15	Unclear	5
Present study	175	4.3-66	15	17

various techniques and showed that 20% had subnormal maximum flow rates, mostly after a tubularized preputial island flap.<sup>11</sup> MacMillan et al had the most differentiated study with 3 separate age groups (3 to 7, 8 to 14 and 15 to 21 years old, respectively).<sup>12</sup> Only 2 patients had low flow rates in the youngest group (5% of total). However, this population consisted entirely of patients treated with the meatal advancement and glanuloplasty technique and, therefore, all had relatively low grade hypospadias. Our series consisted of 175 patients with initial moderate to severe hypospadias, the majority of whom underwent repair using 2 techniques with long-term followup, a fact that unfortunately is only mentioned in the reports by Svensson (mild to severe hypospadias)<sup>8</sup> and McMillan (all anterior hypospadias)<sup>12</sup> et al.

Spraying was observed infrequently and low maximum flow rates were seen mostly in the younger age group (3 to 7 years old, or 50%) but not with increasing age. This tendency for a higher number of low flow rates with younger patients is consistent in all reports differentiating for age. A possible explanation can be that at short-term followup the newly constructed urethra is relatively small in diameter and semirigid. After several years of voiding pressure and wound healing this urethra could have become more elastic and broad. However, these conclusions can be drawn only from a prospective study with consecutive uroflowmetry in the same patient. Unfortunately, such a study has been reported.

#### CONCLUSIONS

No differences concerning uroflowmetry data could be established between patients undergoing the van der Meulen technique or combined Byars-Denis Browne repairs. Uroflowmetry in our report as well as in others suggests a larger number of restricted flow data at a relatively younger age. Further studies are necessary to disclose this consistent finding.

The clinical relevance of low flow rates remains another unsolved problem because all reports demonstrate a strong discrepancy between low flow rates and patient complaints or abnormal physical signs. Evaluation of hypospadias surgery should include uroflowmetry at consecutive intervals postoperatively throughout adolescence. Only in this way can an objective comparison be made among various operative techniques.

Mrs. A. Groenendijk processed the uroflowmetry data.

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#### EDITORIAL COMMENT

The authors are to be commended for evaluating the functional results of hypospadias repair for the last 30 years. Measuring flow rates after repairs involving urethral reconstruction should be standard evaluation of these patients. Although the significance of a decreased maximum flow rate after urethroplasty is not well understood, Garibay et al (reference 11 in article) found a good correlation between decreased peak flow and stricture, and were able to improve the flow after repair of the stricture. Uroflowmetry should be a standard method to evaluate new techniques described and to assess the long-term results of established operations. The fact is that in most series, including the present one, less than 80% of patients achieve a normal flow and, if only cases of hypospadias with a meatus located proximal to the corona are considered, the proportion of normal flows is considerably lower. I hope that this study will stimulate surgeons to evaluate results carefully and to choose the techniques with the best potential functional results, avoiding circumferential anastomosis whenever possible.

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#### REPLY BY AUTHORS

Absence of a corpus spongiosum around the neourethra, maturation of scar tissue, and size and placement of scars have an influence on postoperative uroflowmetry. These different characteristics, however, have different time schedules, which may explain the decreasing number of low flow rates with increasing age in our study. Therefore, we strongly advocate the use of uroflowmetry at regular intervals for patients who undergo surgery for hypospadias. Uroflowmetry until adolescence will provide accurate information about the natural course of urethral development following hypospadias repair.